DSPD56362EVM

Upgrade Manual
Revision 3.1

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Introduction

This document provides a description of how to upgrade the standard DSP56362EVM Evaluation Module to the DSPD56362 and related components. After the upgrade is complete the EVM system will be capable of autodectect/autoswitching of PCM, Dolby Digital™, DTS™ and MPEG bitstreams in addition to various post decoder functions. The user interface of the upgraded EVM is also described.

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SECTION 1
UPGRADE INSTRUCTIONS

1.1 INTRODUCTION

This section describes the instructions on how to upgrade the DSP56362EVM to have DSPD56362 decoder functionality. The DSP56362EVM upgrade kit allows user to replace the DSP, 68HC11, and EPROM to add the following functionalities to the EVM:

- Auto-detection of Dolby Digital™, DTS™, MPEG and PCM source.
- Standalone operation of EVM.
- LCD user interface for control and status operations.

1.2 UPGRADE KIT CONTENTS

The DSP56362EVM upgrade kit contains the following items:

- DSPD56362 Rev. D digital signal processor
- MC68HC711E9 Rev 3.0 microcontroller
- AT27LV010A Rev 1.0 EPROM
- Jumpers
- EVM Supplement Manual (this document)

The DSPD56362 Applications User Manual can be downloaded from Motorola's website:

http://mot-sps.com/ADC/markets/dspaudio/DSP56362.html

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UPGRADE INSTRUCTIONS

1.3 UPGRADE INSTRUCTIONS

Figure 1-1 shows the location of the DSP, 68HC11, and EPROM. These components need to be replaced with the components included in the upgrade kit. Pin 1 is indicated by the black dot.

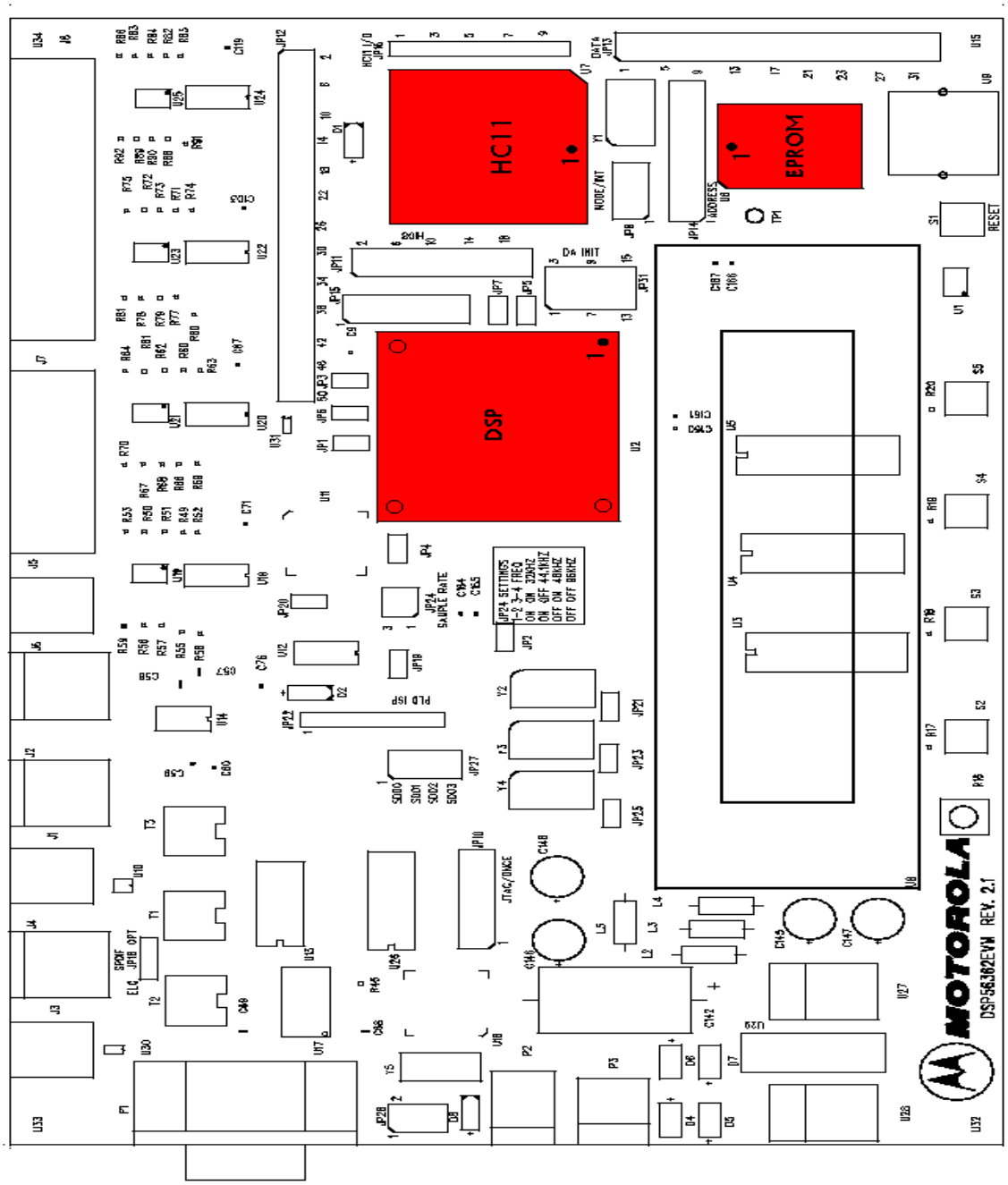

Figure 1-1 Upgradeable Devices

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UPGRADE INSTRUCTIONS

1.3.1 DSP Replacement

To upgrade the DSP:

1. Use a Philips-head screwdriver to remove the 4 screws on the DSP socket U1.
2. Remove the socket top.
3. Remove the generic DSP using a chip suction device and replace it with the DSP included in the upgrade kit. Verify that the DSP is placed in the socket securely and that the pins make contact with the socket. Refer to **Figure 1-1** for the correct orientation of the DSP.

   Caution: To avoid damaging the DSP, use an anti-static wrist band when handling this device. Using a device other than a chip suction device to lift the DSP may damage the fine-pitched pins.

4. Replace the socket top and screw the top down.

1.3.2 68HC11 Replacement

To upgrade the 68HC11:

1. Remove the 68HC11 microcontroller from the socket U7 using a PLCC chip extractor device.
2. Replace the component with the 68HC11 included in the upgrade kit. Refer to **Figure 1-1** for the correct orientation of the 68HC11.

1.3.3 EPROM Replacement

To upgrade the EPROM:

1. Remove the EPROM from the socket U6 using a PLCC chip extractor device.
2. Replace the component with the EPROM included in the upgrade kit. Refer to **Figure 1-1** for the correct orientation of the EPROM.

1.3.4 Jumper Settings

Figure 1-2 shows how to modify the jumper settings:

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UPGRADE INSTRUCTIONS

1. Place a jumper from JP11 pin 14 to JP11 pin 17. (PB13 to +3.3V)
2. Place a jumper from JP11 pin 15 to JP11 pin 6. (PB14 to GND)
3. Place jumpers on JP8 pins 1-2, 5-6, and 7-8. (MODE 2)

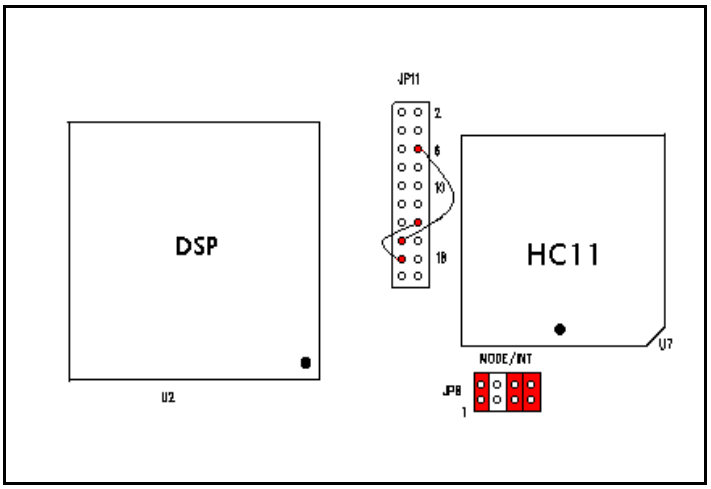

Figure 1-2 Jumper Settings

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SECTION 2
DEMONSTRATION INSTRUCTIONS

2.1 INTRODUCTION

This section describes the instructions on how to setup the EVM to demonstrate Dolby Digital™, Dolby Pro Logic™, DTS™ and MPEG decoding.

2.2 REQUIRED EQUIPMENT

- Dolby Digital™, DTS™, or PCM source, i.e. DVD, Laserdisc, DAT, CD, VHS, etc.
- An audio amplifier driving headphones or speakers as shown on the following page in **Figure 2-1**
- 7-9V AC/DC power supply

2.3 DEMONSTRATION SETUP

1. Verify that the DSP, 68HC11, and EPROM have been upgraded as described in **Section 2.3**.
2. Verify that the jumper modifications have been made as described in **Section 1.3.4**.
3. Verify that the jumper settings are correct as shown in **Figure 2-2**. The default jumper setting assumes that an optical cable is used to connect the input to the EVM. However, if using a coaxial cable, move the jumper on JP18 to pins 1-2.
4. Connect the input and output cables to the EVM as shown in **Figure 2-1**.
5. Apply 7-9V AC/DC to the power connector P2.

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Demonstration Setup

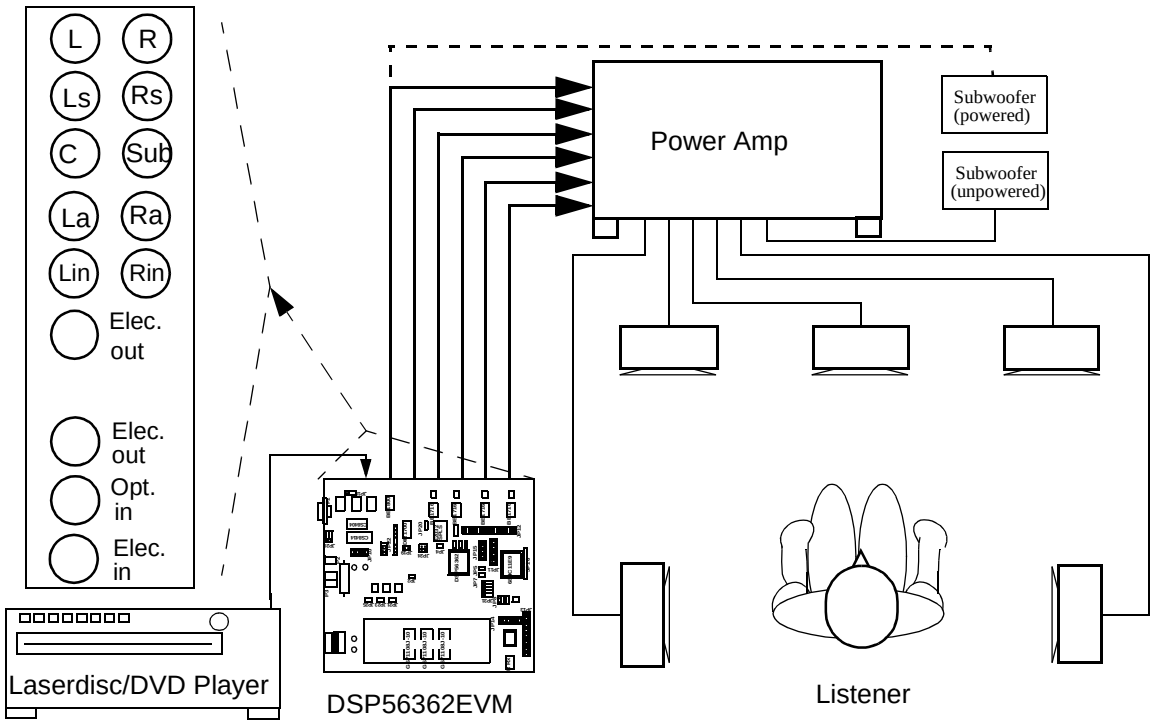

Figure 2-1 Home Theater Demonstration

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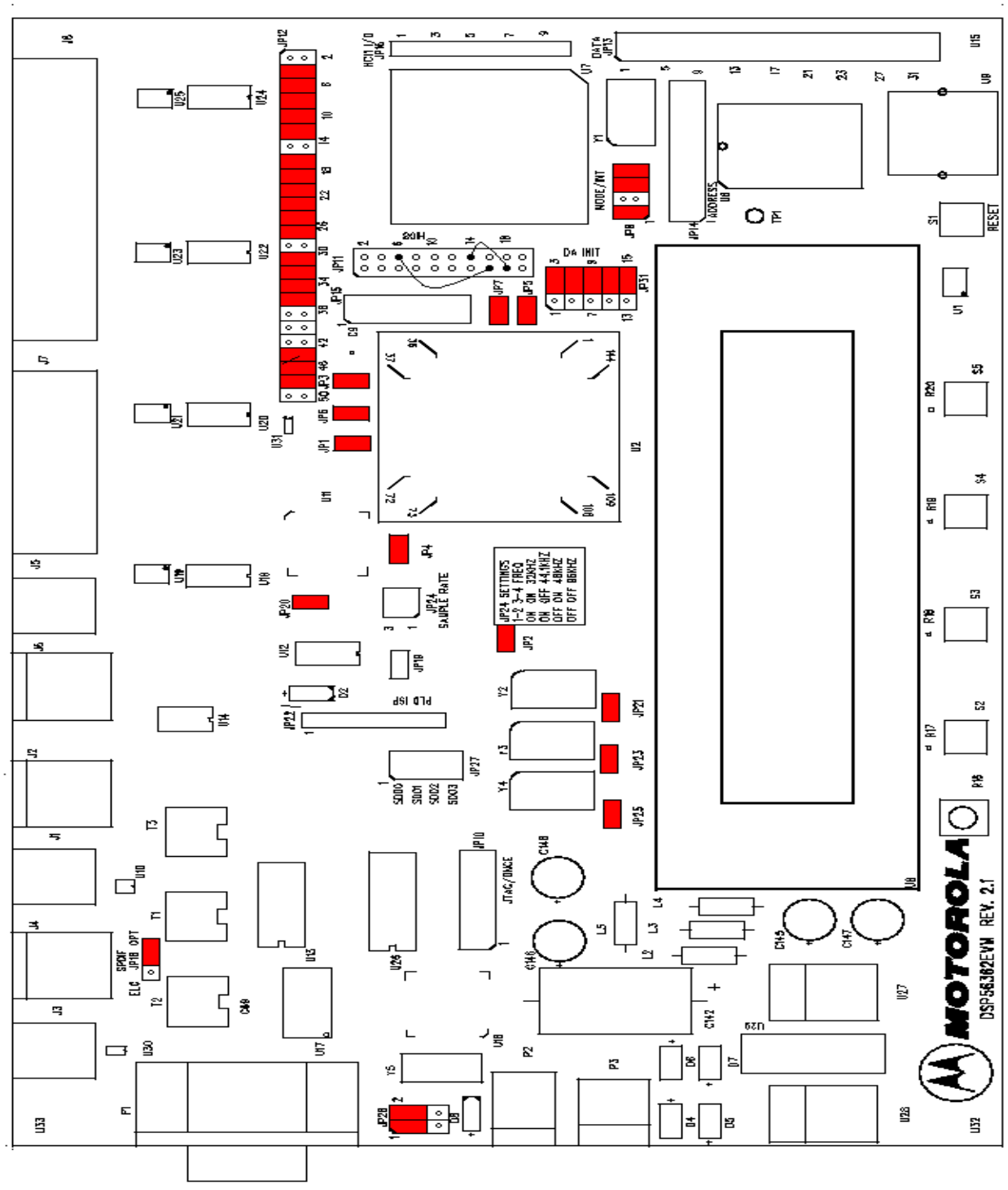

Figure 2-2 Jumper Settings

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2.4 USER INTERFACE

Figure 2-3 illustrates the different screens of the LCD panels and the corresponding actions of the pushbutton switches.

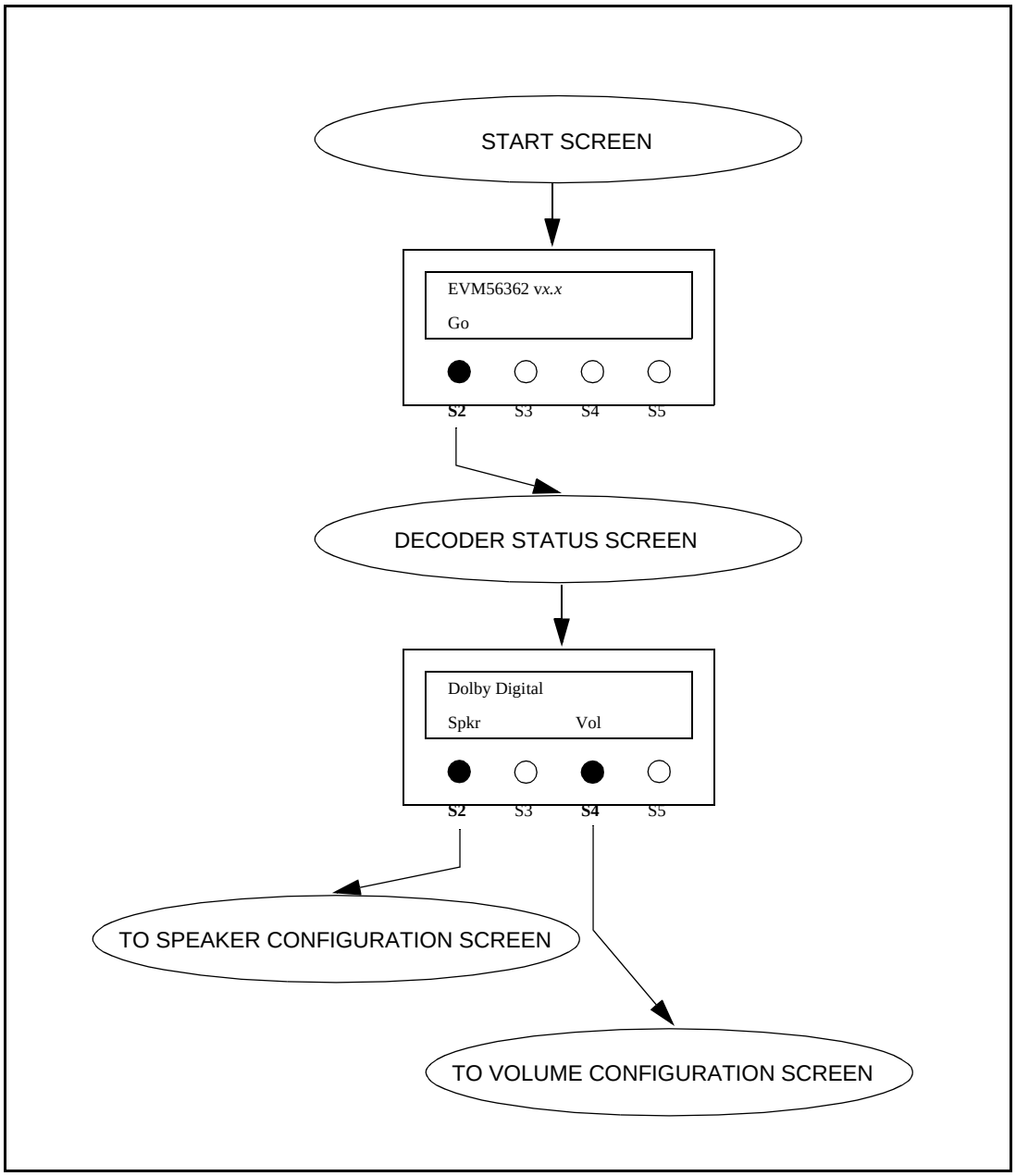

Figure 2-3 LCD Screens

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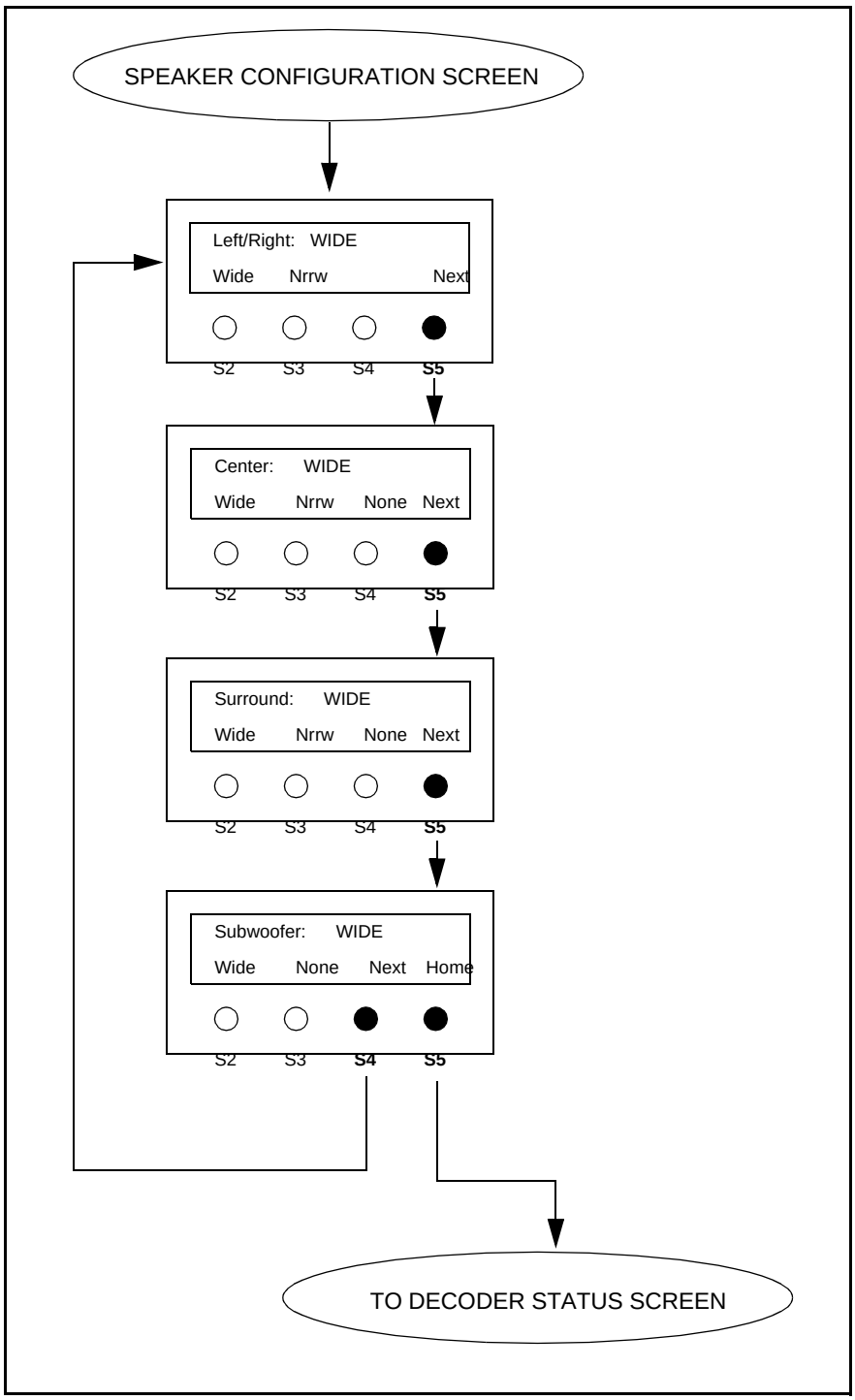

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User Interface

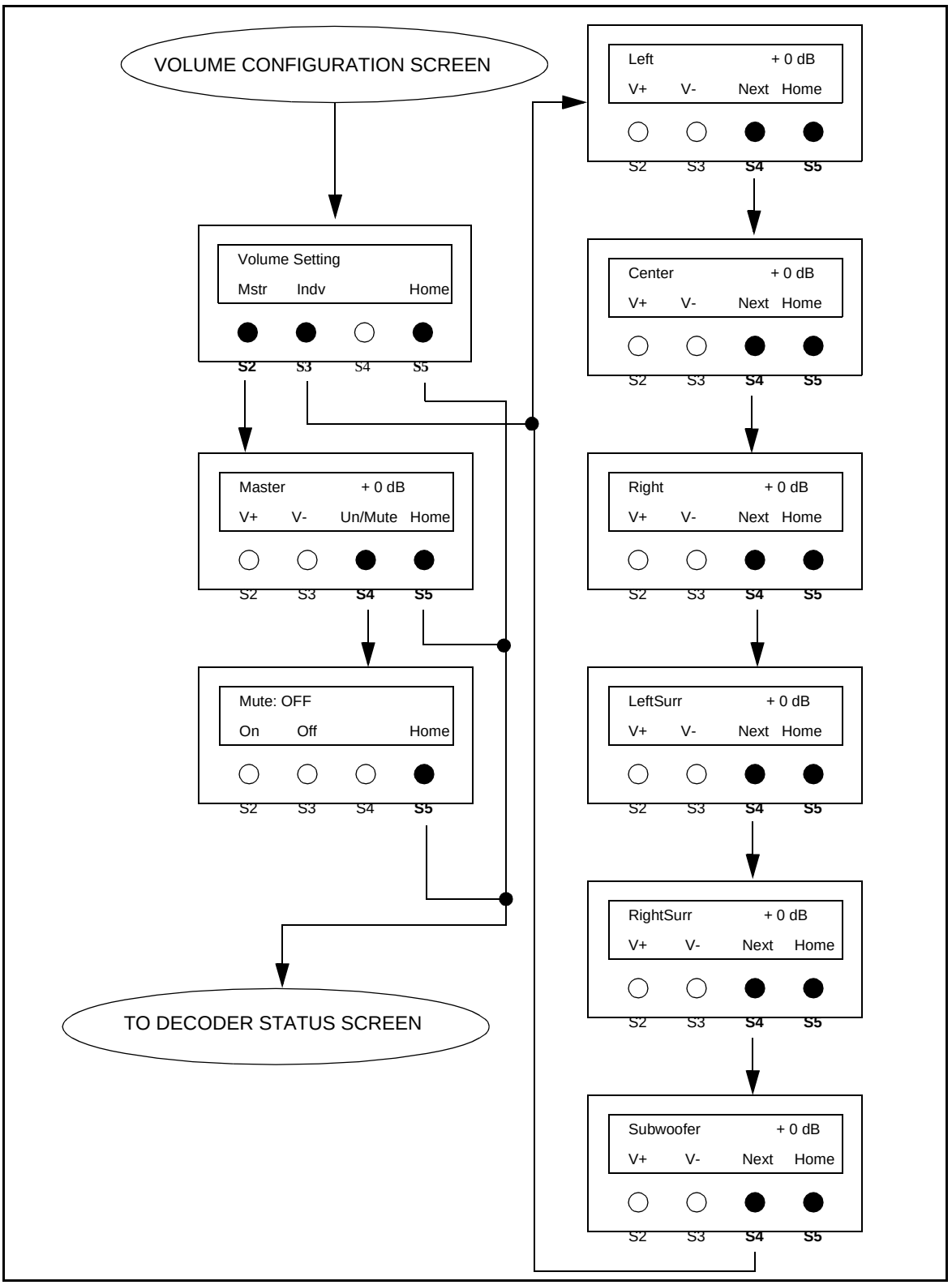

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Figure 2-4 LCD Screens (cont.)

2.4.1 LCD Screen Description

The EVM's user interface allows the user to perform the following functions:

- Activate the DSP decoder functionality
- Obtain decoder source type status information
- Select speaker configuration
- Control the master volume
- Control the individual channels volume
- Control mute and unmute

2.4.2 Decoder Activation

Once power is applied to the EVM, the Start Screen will be displayed on the LCD panel. Pressing the **S2** button ('Go') will activate the decoder and the LCD will display the message 'Wait...' until a software patch is downloaded to the DSP. After several seconds, auto-detection is activated and the decoder type is shown on the screen.

2.4.3 Decoder Source Type

It is not necessary to reset the EVM when changing the source (AC-3, DTS, MPEG or PCM). Once the change is made the LCD panel will automatically display the current decoder source type on the Decoder Status Screen.

2.4.4 Speaker Configuration

Pressing the **S2** button ('Spkr') while in the Decoder Screen gives the user control of the speaker configuration. The default configuration for the left, right, center, surround, and subwoofer speakers are initially set to 'Wide' mode. However, the user has the option of changing the left, right, center, and surround speaker configuration to 'Narrow' mode or turning off the center, surround and subwoofer speakers for a two-speaker configuration. Pressing the 'Next' button allows the user to

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configure the next speaker. **Table 2-1** summarizes the available speaker settings. If the source is PCM, the DSP assumes the source is surround encoded and decodes the bitstream as Dolby Pro Logic.

Table 2-1 Speaker Configuration

SPEAKER	SETTINGS
Left/Right	**Wide** - default Narrow
Center	**Wide** - default Narrow None
Surround	**Wide** - default Narrow None
Subwoofer	**Wide** - default None

2.4.5 Volume Control

Pressing the **S4** button ('`Vol`') while in the Decoder Screen gives the user control of the master and individual channel volume. The default master and individual channel volume setting is 0 dB.

2.4.5.1 Master Volume Control

Pressing the **S2** button ('`Mstr`') while in the Volume Screen gives the user control of the master volume. In the Master Volume Screen, the master volume may be changed by pressing the **S2** button ('`V+`') to increase the volume or the **S3** button ('`V-`) to decrease the volume in increments of 1 dB. The volume range is from -64 dB to +64 dB.

The master volume may be muted and unmuted by pressing the **S4** button ('`Un/Mute`') and selecting '`On`' or '`Off`'.

Pressing the **S5** button ('`Home`') changes the display back to the Decoder Screen.

2.4.5.2 Individual Volume Control

Pressing the **S3** button ('`Indiv`') while in the Volume Screen gives the user control of the individual channel volume. In the Individual Channel Volume Screen, the individual channel volume may be changed by pressing the **S2** button ('`V+`') to increase the volume or the **S3** button ('`V-`) to decrease

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the volume in increments of 1 dB. The volume range is from -64 dB to +64 dB. The **S4** button (‘Next’) allows the user to cycle through the different channels.

Pressing the **S5** button (‘Home’) changes the display back to the Decoder Screen.

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User Interface

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SECTION 3
68HC11 SOURCE CODE DESCIPTION

3.1 INTRODUCTION

This section gives a brief description of how the 68HC11 microcontroller code works in case the user needs to make modifications or additions to the user interface.

3.2 MAIN FUNCTION

The following steps are taken in the main function of the code:

1. **`InitRegs( )`**- Initialize 68HC11 control registers:
   - Configure Port A pins to be inputs from switches S2, S3, S4, and S5.
   - Configure Port B pins to be outputs to LCD and D/A converters control signals.
   - Configure Port C pins to be outputs to LCD data lines.
   - Configure Port D pins to be input from and outputs to DSP's SHI port.
2. **`InitVol( )`**- Initialize D/A converters:
   - Configure D/A converters to operate in software mode.
   - Initialize attenuation and input data format for all four D/A converters.
3. **`InitKey( )`**- Initialize key input manager:
   - Configure keypad action on the EVM.
4. **`InitLCD( )`**- Initialize LCD manager:
   - Configure to display messages on the LCD.
5. **`InitParams( )`**- Initialize parameters:
   - Initialize left, right, center, surround, and subwoofer volume at 0 dB.
6. **`SetMode(BOOT_MODE)`** - Display initial screen on LCD.

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- Run InitAV2( ) function
- Run RunPatch( ) function.

7. Enable interrupts and wait for keypad inputs.

3.3 SYSTEM-SPECIFIC CONFIGURATION

The **`InitAV3( )`** function configures specific DSP registers for the EVM56362. However, other systems may require different settings and this function may need to be modified. These system differences may affect the following:

- Multiplication factor in the PCTL.
- Address attribute AAx signals for selecting external memory devices.
- Number of wait states for each AAx signal in the BCR.
- ESAI receive and transmit configuration.

Table 3-1 shows the default DSP register settings for the EVM56362.

Table 3-1 InitAV2 Default Settings

REGISTER		ADDRESS	VALUE	DESCRIPTION
PLL	PCTL	0xFFFFFD	0x0F000B	DSP operating frequency of 96Mhz
BUS INTERFACE	AAR0	0xFFFFF9	0x0C063D	Additional address line A18
	AAR1	0xFFFFF8	0x080539	Map external EPROM access X/Y/P:$080000 to $0FFFFF
	AAR2	0xFFFFF7	0x040639	Map external SRAM access X/Y/P:$040000 to $07FFFF
	BCR	0xFFFFFB	0x0005E1	AAR0 1 wait state AAR1 15 wait staes AAR2 1 wait state
INTERRUPT PRIORITY	IPRP	0xFFFFFE	0x000187	ESAI interrupt priority level 2 DAX interrupt priority level 1 Timer, SHI interrupt level 0

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Table 3-1 InitAV2 Default Settings (Continued)

REGISTER		ADDRESS	VALUE	DESCRIPTION
ENHANCED SERIAL AUDIO INTERFACE	SAICR	0xFFFFB4	0x000000	Independent clock and frame sync signals for Rx and Tx (asynchronous)
	RCR	0xFFFFB7	0x714902	RX1 is enabled, shift data in MSB first, left-aligned data word, network mode, 32-bit slot length, 16-bit word length, word-lenght frame sync, frame sync occurs 1 serial clock cycle earlier, Rx, Rx exception, and Rx even data slot interrupts are enabled
	RCCR	0xFFFFB8	0x0C0200	Fixed divide by 8 prescaler is operational, 2 words per frame, falling edge of Rx clock is used to clock data in and frame sync, rising edge of Rx clock is used to latch data in and frame sync, frame start indicated by low level on frame sync pin
	TCR	0xFFFFB5	0x717D0F	TX0, TX1, TX2 and TX3 are enabled, shift data out in MSB first, left-aligned data word, network mode, 32-bit slot length, 24-bit word length, word-length frame sync, Tx, Tx exception, and Tx even data slot interrupts are enabled
	TCCR	0xFFFFB6	0x0C0200	Fixed divide by 8 prescaler is operational, 2 words per frame, falling edge of Tx clock is used to clock data out and frame sync, rising edge of Rx clock is used to latch the data and frame sync in, frame start is indicated by low level on frame sync pin
	RSMA	0xFFFFBB	0x000003	Receive a data word and generate a receive full condition RDF=1 for slots 1 and 2
	RSMB	0xFFFFBC	0x000000	Only slots 1 and 2 are used
	TSMA	0xFFFFB9	0x000003	Transmit a data word and generate a transmit empty condition TDE=1 for slots 1 and 2
	TSMB	0xFFFFBA	0x000000	Only slots 1 and 2 are used

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3.4 MODE SCREENS

Each screen is defined by the current mode as well as the next mode associated with each of the four switches. These modes are stored in the array **tableModes**. The example below shows the format of the mode screen:

```
tableModes[ ] =
{
        {CURRENT_MODE,
                {NXT_MODE_S2, NXT_MODE_S3, NXT_MODE_S4, NXT_MODE_S5},
                "Text Line" 1,
                "Action_S2 Action_S3 Action_S4 Action_S5"},
}
```

In the example below, **BOOT_MODE** is the first screen that is displayed when the DSP is reset. Decoding is started when "Go" is selected by pressing switch S2. When S2 is pressed, the new mode is **DEC_MODE** which displays the decoder type. Pressing switch S3, S4, or S5 does not initiate any action, thus **NO_MODE** is the next mode.

```
tableModes[ ] =
{
   {BOOT_MODE,
      {DEC_MODE, NO_MODE, NO_MODE, NO_MODE},
      "EVM56362",
      "Go"},
}
```

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3.5 EVENT-HANDLER FUNCTION

The **ProcessEvent( )** function processes the events according to the current display mode and keypad action. For example, if the current mode is **MUTE_MODE**, the **ProcessEvent** function sends the mute command to the DSP if switch S2 is pressed, or it sends the unmute command to the DSP if switch S3 is pressed, or sets the mode to the decoder status mode **DEC_MODE** if S5 pressed.

```
ProcessEvent ( )
{
   case(MUTE_MODE):
   {
      send MUTE opcode if S2 is pressed
      send UNMUTE opcode if S3 is pressed
      return to start screen if S5 is pressed
      break;
   }
}
```

3.6 SPI COMMUNICATION

Communication between the 68HC11 host microcontroller and the DSP is via SPI. The host is configured as the master and the DSP is configured as the slave. The **ExchangeSPI_DSP (rx_addr, tx_addr)** function performs the SPI communication by exchanging 3 bytes. Data at address **tx_addr** is transmitted to the DSP and data received from the DSP is stored at address **rx_addr**.

3.6.1 Receiving Data from the DSP

The 68HC11 can receive a data word from the DSP by using the **GetDSP (opcode)** function. This function is used for receiving status information from the DSP. The **opcode** parameter specifies the status command. For example, the command

```
DSP_REPLY = GetDSP (MODE_SOURCE)
```

prompts the DSP to reply with the decoder type. In this case, the parameter **MODE_SOURCE** is the command **0x0A02100**. The reply may be Dolby Digital, DTS, MPEG, or PCM. The status opcodes are listed in the DSP56362 Applications User Manual.

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3.6.2 Transmitting Data to the DSP

The 68HC11 can transmit a data word to the DSP by using the **SendDSP (opcode)** function. This function is used for transmitting control commands to the DSP. The **opcode** parameter specifies the control command. For example, the command

```
SetDSP (MUTE)
```

sends the control opcode to mute the outputs of the DSP. In this case the parameter **MUTE** is the command **0xE08480**. The control opcodes are listed in the DSP56362 Applications User Manual.

The **SetDSP** function has other variations depending on the number of data words to send. These variations include:

```
SetDSP2 (opcode, data)
SetDSP3 (opcode, address, data)
SetDSP4 (opcode, address, data1, data2)
SetDSP5 (opcode, address, data1, data2, data3)
```

When multiple data words are transmitted, these words are stored in contiguious memory locations. Forexample, **data1** will be stored at **address** and **data2** will be stored at **address+1**.

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